SEARCH FOR PREPARATIONS FOR PRESERVATION OF FECES FOR USE UNDER SPACE FLIGHT CONDITIONS

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Among the many measures directed toward the creation of satisfactory /435
flight conditions, a special place is occupied by the prevention of bacterial contamination and, in particular, the prevention of putrefaction and fermentation of excreta by the action of microorganisms.

In my opinion, only substances free from pungent odor and toxicity are suitable for use for preservation and deodorization under space flight conditions.

Chlorine preparations such as chloride of lime, calcium hypochlorite, chloramine, etc., and phenol preparations (cresol, lysol, phenol and their deriv- /436
atives in combinations with alkalies) are most commonly used for disinfection of human excreta at the present time.

I refrained from using these preparations because of their strong odor, toxicity, the fact that some are branded articles, and they corrode metals. Their use even in exceedingly low concentrations in a small, confined space would make it impossible for man to remain there.

To preserve food products and biological preparations, acids (boric, sulfosalicylic, citric), salts (sodium chloride, sodium citrate), and broad-spectrum antibiotics (penicillin, chlortetracycline, oleandomycin, niacin, etc.) are used.

Quaternary ammonium compounds are being increasingly used in practice for the disinfection of dishes, surfaces, linen, and so on [2, 3].

Ye.N. Nikiforova disinfected a fecal suspension with the preparation "Katamin A," belonging to the group of quaternary ammonium compounds and used in containers of aircraft toilets. We therefore tested several preparations from this group for the preservation of feces.

Salts of silver, copper and manganese and also hydrogen peroxide are used for water preservation. The use of salts of heavy metals (copper sulfate and chloride) for disinfection and for prevention of fermentation and putrefaction of feces has been known for a long time.

G.F. Gauze [1] considers that during prolonged contact between biological materials and silver salts, active ions enter the medium with gradually increasing intensity, replacing bound ions and thus ensuring prolonged anti-bacterial activity.

We concluded from data in the literature that for the purposes of preservation of feces under space flight conditions, it is most rational to concentrate

TABLE 1. Effect of Preparations Added to Feces on Effectiveness of Preservation

Preparation	Quantity of preparation added to 100 g feces	Results of seedings after:		
		5 days	10 days	15 days*
Silver fluoride	1,0	+	+	+
	3,0	+	−	−
	5,0	−	−	−
	8,0	−	−	−
Silver nitrate	1,0	+	+	+
	5,0	++	−	−
	6,0	+	−	−
	8,0	−	−	−
	10,0	−	−	−
Silver sulfate	5,0	+	−	−
	7,0	±	−	−
	8,0	−	−	−
	10,0	−	−	−
Silver oxide	1,0	+	+	±
	5,0	±	−	−
	8,0	−	−	−
Copper salt "V"	1,0	+	+	±
	5,0	±	−	−
	7,0	−	−	−
	8,0	−	−	−
Copper sulfate	5,0	+	+	+
	10,0	++	+	−
	20,0	±	−	−
	25,0	±	−	−
	30,0	−	−	−

*Starting from 20 days and until 12 months none of the preparations weakened the preservative effect.

Commas represent decimal points.

attention on the study of preparations from the following groups of chemical compounds: salts of heavy metals, quaternary ammonium compounds, antibiotics and oxidizing agents.

Altogether 24 preparations were studied under laboratory conditions.

Samples of feces (50 g) were placed in sterile glass dishes and sprinkled with the test preparations in doses of 10 g/100 g feces. After mixing the feces with the preservative with a glass rod, the samples were placed in a dark cupboard at room temperature for 100 days. The temperature was recorded daily. Samples of feces without addition of preservatives acted as control. The effectiveness of preservation was assessed by taking seedings from the experimental and control samples on nutrient media (meat-peptone agar, meat-peptone broth, Endo's medium, liver broth with cysteine).

Seedings were made 5, 10, 15, 20, 25, 30, 60 and 100 days after the beginning of contact between the feces and test materials. The results of tests of preservatives of the feces for 100 days at the rate of 10 g/100 g feces are given in Table 2. /437 /438

TABLE 2.

Effective	Ineffective	Ineffective
Silver fluoride	Sodium chloride	Cetyloctadecylpyridinium bromide
Silver nitrate	Potassium permanganete	Cetyloctadecyltrimethylammonium bromide
Silver sulfate	Boric acid	C-4
Silver oxide	Calcium oxide	Cetyloctadecyltriethylammonium bromide
Copper salt "V"	Penicillin	Hydrogen peroxide
Copper sulfate	Synthomycin	
Crystalline iodine	Chloramphenicol	
Feziomon	Erythromycin	
Katamin "K"	Oleandomycin	
PTA		

We next studied the efficacy of six selected preparations suitable for preservation of feces and determined their minimal dose. The results of these experiments are shown in Table 1.

It is clear from Table 1 that preservation of feces by silver (fluoride, nitrate and sulfate) and copper preparations is possible with a dosage of 5-8 g/100 g feces. Copper sulfate has a weaker action, being effective only in a dose of 30 g.

Long exposures up to one year (end of the period of observation) did not weaken the preservation effect.

The specific odor of feces was considerably weakened (deodorizing effect), but it proved impossible to remove the odors arising from chemical decomposition of the organic substances completely.

When the preserved samples were dried, their odor disappeared completely.

If the cost of the preparations is compared with their efficacy, in our opinion the advantage rests with copper salt "V".

REFERENCES

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